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ABSTRACT

This paper recounts the use of a computerized multiple-measures placement model at Yuba College in Marysville, California. Yuba began using computerized placement tests in 1994, based on suggestions from faculty and student assessment staff. Two years later, a set of multiple measures criteria, consisting mainly of self-reported high school history was selected to weigh scores in placement recommendations. In spring 1997, new placement criteria were implemented for students testing for fall enrollment, and all placement recommendations were made by the computerized system. By fall 1997, student success among those placed by the test was above 70% in many basic skills courses. The placement accuracy ratio increased to more than .80. Conclusions of this pilot study show that carefully selected multiple measures applied by a computer to course placement significantly increases placement accuracy. Students whose placements were adjusted through the use of behavioral and historical characteristics were more accurately placed and succeeded at a higher rate than students placed on the basis of test scores alone, and at a much higher rate than those placed by subjective application of undefined multiple measures by counselors. Attached are a cover memo to faculty, and faculty and student surveys. (AS)

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Using Computer Adaptive Testing & Multiple Measures to Ensure That Students are Placed in Courses Appropriate for Their Skill Levels

A Paper Prepared for Presentation at:

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At
San Diego, California

By

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Introduction

Course placement has been determined by most researchers to be one of the major keys to student retention, persistence, and success. Learning takes place when students have the tools with which to learn and are placed in an environment which is conducive to processing information. Students who possess academic skills adequate for the learning environment their course presents are highly likely to succeed in the course. Students who succeed in their initial courses are more likely to persist than students who fail their first college courses. Today's young students would call it a "no-brainer," then, that assessing academic skills so as to place students at the highest level in which they are likely to succeed will promote increased retention and persistence.

California Community Colleges are mandated to use "multiple measures" for course placement. Placement examinations must be approved by a committee according to regulations, and tests must be validated for disproportionate impact content validity, and either criterion or consequential validity. With a limited number of approved tests available, computerized testing has gained momentum. Currently, 23 community colleges are using a form of computerized testing, with a dozen more in various stages of implementation.

With computerized testing comes the ability to expand simple test administration into computerized placement management, and from there to data collection for multiple measures placement. This paper presents the results of a computerized multiple-measures placement model. Information includes: choosing acceptable alternate measures, assigning weight to various measurements, and the results in terms of student success and placement accuracy.

In the Beginning There was Chaos

In 1994, Yuba College began using computerized placement tests. The decision to use ACCUPLACER was based on faculty preference and the experience of the assessment staff with both computerized products. Cut scores were set using a make-shift concordance table developed from the APS test used previously. Placement recommendations were reviewed and, if appropriate, over-ridden by counselors using undefined criteria. Prior to beginning the computerized testing program, student success rates ranged from 45 to 60 percent in basic skills courses, with retention hovering well under 70 percent.

Cut scores were reviewed and adjusted after one semester using final course grades as the dependent variable. Adjustments were minor, usually less than five points on a 120 point scale. Overall student success rates improved slightly, but success rates among those students who had followed placement recommendations improved significantly.

In 1996, a set of multiple measures criteria consisting mainly of self-reported high school history was selected to weight scores in placement recommendations. By fall, 1997 student success

among those placed by the placement test was above 70% in many basic skills courses. The placement accuracy ratio increased to more than .80. Placement accuracy, to be defined later, accounts for both alpha and beta errors in placement.

Multiple Measures Criteria

California regulations do not define multiple measures except to say they cannot include another test. Regulations also do not specify how many measures must be used nor how they must be applied. Selecting which measures to use can become time-consuming and create controversy among participants. Counselors and teaching faculty, although their goals are similar, have different perspectives on what constitutes valid measures. It can be extremely difficult to limit the number of measures available for use, and even more difficult to select those to be included.

Three criteria, consisting only of high school performance, were initially set up as multiple measures criteria and weighted to influence the placement of students whose test scores were near the cutoff. After several failed attempts to establish limits and identify acceptable criteria, meetings were held with department faculty in early Spring, 1997. At each meeting, the operations of the computerized placement system were explained and the limitations were stressed. Manageability of the system was explained. A placement rule must be written for each level of placement for each possible combination of responses to measurement criteria. For example, five questions with five responses each would require 3125 rules *for each level of placement.* At Yuba College, that would mean 15,625 rules each for math and English placement: an unmanageable situation even without considering reading and ESL classes. Faculty were then asked to identify measures their experience had taught them influenced student success. Using a modified affinity process, four to five criteria were selected as the most influential on student success. Once begun, the entire process took less than an hour to complete in each department.

After the criteria had been selected, the relative importance of each was discussed and tentative weight was assigned to each possible response. Experience had taught that negative weight should be limited to only those criteria which might cause a student with adequate academic skills to fail, such as number of units, time available for study, and hours worked. Historic data, such as highest level of study, may influence success beyond that predicted by test scores, but seldom predict failure below the skills demonstrated in the test. Faculty were cautioned against making the system unmanageable with too many possible combinations of responses, and assigning too much weight to any one criterion. When the discussions were ended, language faculty had chosen five criteria, two historic and three behavioral, with a total weight range from .95 to 1.17. Math faculty had chosen four criteria, two each, with a total weight range from .95 to 1.14. By combining response choices into meaningful groups, possible combinations were limited to 144 for each level of placement: a lot of work, but manageable.

Pilot Study

In Spring, 1997, the new placement criteria were implemented for students testing for Fall enrollment. Placement over-rides were allowed with counselor approval, but counselors were encouraged to have students access the challenge process if they were dissatisfied with their placements. All placement recommendations were made by the computerized system. Counselor over-rides accounted for about 15% of all course placements. At transferable levels, nearly 70% of students were placed by having taken a prerequisite course. In the developmental courses, of course, prerequisite placement was not a factor.

Among those students placed by over-ride, fewer than 40% completed the assigned course with a "C" or better. About half dropped the course, and the rest received "D" or "F" grades. The success rate for those students in courses by virtue of prerequisites averaged 67%, with success defined as completing the course with a "C" or "CR" or better. Several courses had lower success rates, and faculty examined and revised course outlines accordingly. The success rates among students placed by the computerized placement system ranged from 61% in a math class to 74% in an English course. This was marked improvement from 1994 data. The graphs in the attached presentation materials indicate the change. One notable exception was a decrease in student success in the vocational level English course. Investigation determined that the course outline had changed and that, in fact, the exit criteria for the course had been raised substantially. The cut score was immediately adjusted, and the problem corrected in the subsequent term.

Due to a substantial number of withdrawals which could not be attributed to failures and the substantial grade variances among faculty teaching the same courses, there emerged a need to identify another means to validate the placement system. Students drop courses for any number of reasons not related to their probability of succeeding in the course. Since drops are not necessarily attributable to the placement system, they must be removed from the sample before analysis. This substantially reduces the sample size and brings into question sample validity and reliability. Although research indicates that perception of failure is not a substantial reason for students to drop classes, eliminating those students from the analysis leaves the appearance of a contaminated sample. Grade variance, of course, always creates noise in the data set and distorts placement research results. The result was the development of "Placement Accuracy," a method of assessing the placement system rather than just student outcomes. Credit for the initial model for this method goes to Darlene Nold and her associates at Aimes Community College, Greeley, Colorado.

Placement Accuracy

Setting a cut score requires making two erroneous assumptions. First, we assume that everyone who scores at or above the cut score will pass the course. Second, we assume that anyone who scores below the cut score would fail the course if admitted. Neither, of course, is absolutely true. The best we can do is place the cut score where errors will be minimized. We can argue

whether we prefer inclusive errors (alpha), where we admit students who will fail the course; or exclusive errors (beta), where we exclude students who would pass the course if admitted. Preliminary extensions of the research discussed here indicate that when placement errors are at their minimum, alpha errors will be higher than beta errors. Placement accuracy is computed by factoring both alpha and beta errors into the success equation.

Surveys was distributed to all faculty and all students in the subject classes after the fourth week, but before mid-term. Forms are attached. The faculty survey was a simple class roster which asked for each student's level of preparation for the materials in the course on a 3-point scale. Students were "under-prepared," "adequately prepared," or "over-prepared." In a second column, faculty were asked to indicate each student's likelihood of earning a "C" or better based on ability alone (Highly-likely, Probable, Highly-unlikely). The latter indicator was used for a validity check. For students who had dropped the course, faculty were asked, if they could, to evaluate whether the student was passing at the time of the drop, assuming that passing meant adequate preparation.

The student survey asked for the anticipated grade for the course, perception of placement accuracy (placed properly, too low, or too high for ability), and the difficulty of the course (moderately difficult, easy, extremely difficult). Definitions of terms were provided on the survey form. Faculty were asked to distribute the survey to students after they had made their evaluations, and to collect the surveys and return them to the assessment center. We received a 100% response rate from faculty, and 76% from students. We did not test the significance of absence on the day the surveys were distributed.

Student responses were highly correlated with faculty responses regarding placement accuracy, as well as anticipated grade. Later tests also found students' anticipated grades highly correlated with actual grades. Faculty likelihood of a "C" or better assessment correlated with actual grade, but only on a dichotomous basis. Grade variance among instructors probably accounted for the inability to find a correlation with the grade scale.

Survey results were separated by course, and appropriate test scores and placement levels were added to the data file. Since placement over-rides were allowed and commonly used by counselors, a significant number of students were enrolled in courses above their placement levels. The sample was sorted by placement method: placement examination, over-ride, and prerequisite course. Placement accuracy was determined by dividing the number of students rated adequately prepared who were at their placement levels (S) plus the number of students rated under-prepared who were above their placement levels (U) by the total course enrollment (E): ((S+U)/E). This method counts those students who were enrolled above their placement levels and rated adequately prepared (A) as failures of the placement system, along with those who were rated over-prepared (O) and those enrolled at their placement levels and rated under-prepared (P). The following table illustrates the placement accuracy model.

Placement \ Enrollment	At Placement Level	Above Placement Level
Accurate	Adequately Prepared	Under-Prepared
Inaccurate	Under-Prepared Over-Prepared	Adequately Prepared Over-Prepared

A few students were actually enrolled below their placement levels. This, of course, was the result of personal choice, and unless they had been rated under-prepared for their courses (none was) there was not a means to evaluate their placement accuracy. Their records were discarded.

Across all evaluated courses, the placement accuracy ratio from the placement exam and computerized multiple-measures placement system was .78. High ranged to .84, and low was .71 for the placement system. Prerequisite courses had a placement accuracy ratio of .68, and over-rides .38. Using scores alone, without the multiple measures factors, the test had an accuracy ratio of .73 overall. Among those students who had been placed by counselor over-ride, nearly all of those who were rated adequately prepared would have been placed in the course with the revised multiple measures placement system.

Conclusions

Carefully selected multiple measures applied by a computer to course placement increases placement accuracy significantly. Students whose placements were adjusted through the use of behavioral and historical characteristics were more accurately placed and succeeded at a higher rate than students placed on the basis of test score alone, and at an extremely higher rate than those placed by subjective application of undefined multiple measures by counselors. Students succeeded in their initial placement courses at a higher rate as a result of computerized multiple-measures placement.

Adjustments made to placements on the basis of a limited number of clearly defined measurable characteristics are valid for placing students into a proper learning environment. Adding other characteristics to the equation does not seem to improve the accuracy of placements, especially if those characteristics are added subjectively. Given that proper placement improves retention and persistence, factoring historical and behavioral characteristics into placement

recommendations offers significant improvement to the learning environment for those students affected.

Need for Further Research

More research is needed in tracking the use of various non-test placement measures into long-term student outcomes. Research questions include: Do students placed by a multiple measures system differ significantly from students self-placed or those placed on the basis of test alone in their success rates in subsequent courses; retention, persistence, transfer, graduation rates; and other measures of student success? Do students from classes in which all students were placed by a multiple-measures and prerequisite placement system differ significantly from other students on the basis of their performance in subsequent courses and other outcomes measurements? Which student characteristics that are collectable on a self-reported basis are valid for use in multiple-measures placement schemes?

Attachments

1. **Cover memo to faculty**
2. **Faculty survey**
3. **Student survey**
4. **Slides with note space**

Memorandum

Yuba Community College District **Room 113**
Office of Research & Assessment **Phone 741-6864**

Date: January 7, 1999

To: English Faculty
From: Dr. Ron Gordon
Subject: **Placement Evaluation**

Copy: Jay Drury

Attached are rosters for your current English classes. On each are spaces for you to evaluate how accurately each student was placed in your course. This information will be used to readjust cut scores for English placement and to fine-tune the placement system. Please evaluate first how accurately you believe the system was if it placed the student in your course. The student was placed either too low, meaning he or she should have been placed in the next higher level course; too high, meaning she or he should have been placed at a lower level, or accurately, meaning the student has a high probability of succeeding in your class. PLEASE BASE YOUR EVALUATION ON THE STUDENTS' ABILITY ONLY, NOT ON ATTENDANCE, MOTIVATION, OR OTHER FACTORS WHICH AFFECT GRADES. This survey is to evaluate the placement system and its ability to place students according to their abilities.

Second, please indicate your impression of how likely each student, based on ability alone, would be to earn a "C" or better in your class. When you have finished, please return the forms to Research & Assessment, or ask Pat to put them in my mailbox. As soon as I get all the forms back, I'll evaluate the placement results, then meet with department faculty to discuss revising placement criteria. I realize that completing these forms thoughtfully will take some time, and I appreciate your patience. I believe it is the only way we can establish cut scores that will help students get to the classes that will make them successful. Please make every effort to evaluate fairly and to return the forms in a timely manner.

Thank you for your help.

Faculty Survey for Placement Validation

Course: Math 50 Prerequisite: Math 110/111

Term: Fall, 1997 Class Code: #####

In the space labeled "PREPARED" after each student's name, please indicate whether the student is: 1 = Under-prepared for the class (does not possess adequate skills to comprehend the new materials presented in this class), 2 = Adequately prepared (possess the skills to complete the course successfully with a normal amount of study and tutoring), 3 = Over-prepared (Highly likely to succeed in the next higher course). In the space labeled "SUCCESS", please indicate the likelihood that each student will earn a grade of "C" or better based on ability alone: 1 = Highly likely, 2 = Probable, 3 = Highly unlikely.

This information will be used to help evaluate and validate the placement cut scores and the placement system as required by regulations. Please reply promptly by returning this survey to the Office of Research and Assessment, Room 114.

SSN	NAME	PREPARED	SUCCESS

This area contains the class roster.

Yuba Community College District

Student Placement Survey

Course: English 51

Please answer each question below by selecting the answer which most closely agrees with your placement in this course. This information will be kept confidential and will not affect your grade or other activities related to this course.

How well do you believe you were prepared for the work in this course?

Not prepared, Adequately prepared, Over-prepared

Do you find the usual assignments in this course to be:

Too difficult? Within your capabilities? Too easy (already know the material)?

What grade do you believe you will earn in this course?

A B C D F